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(72) Inventors HANSWILLI VON BRACHEL, MASSIMO STOLFI,
BRUNO REZZANI and SAVERIO FRIGERIO(54) PROCESS FOR PREPARING AMINO-PHENYL-UREAS
AND AMINO-CARBANYLATES

(71) We, AZIENDE COLORI NAZIONALI AFFINI ACNA S.p.A., of Largo Guido Donegani 1/2, 20121 Milano, Italy, an Italian Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a particularly simple and selective process for preparing amino-phenyl-ureas and amino-carbanylates.

These materials are of great interest in the fine chemicals field, especially in connection with dyestuffs, as they are basic intermediates for the synthesis of dyes. In particular they are useful as herbicides and as coupling compounds in the preparation of azo dyes, as is described, for example, in Belgian patents Nos. 694 733, 702 400 and 694 633.

It is an object of the invention to provide a particularly simple process, which permits amino-phenyl-ureas and aminocarbanylates to be obtained on an industrial scale, the synthesis of these materials by conventional methods being usually very difficult.

According to the invention, phenyl-ureas and carbanylates are aminated in an acid medium with an N-halo-amine and a reducing salt forming a redox system with the halo-amine. Suitable salts include in particular ferrous, titanous and cuprous salts. Suitable acid media include sulphuric acid, trifluoroacetic acid and mixtures of these with acetic acid.

The phenyl-ureas and the carbanylates can be N-substituted for example, by alkyl, aralkyl, cycloalkyl or aryl groups, which groups may themselves be substituted.

Also the phenyl can be substituted, for instance, by halogen, alkyl, nitro, cyano, hydroxyl or alkoxy.

The reaction takes place over a very broad temperature range — generally from -60 to +100°C; good results are achieved, for example, between 0°C and 40°C, so the process can conveniently be conducted at normal ambient temperatures.

The optimum molar ratio between the N-chloro-amine and the aromatic substrate (phenyl-urea or carbanylate) depends on the particular case, but generally may range from 1:3 to 3:1. The catalyst (reducing salt) may vary in respect of N-chloro-amine from 1:1 to 1:100 molar, the optimum proportions being generally from 1:1.2 to 1:50.

Also with regard to the acid medium, it is possible to employ the most different ratios in respect of the aromatic substrate. A high selectivity and good yields can be achieved, in most cases, by using 300 to 1000 ml of the acid medium for each mole of aromatic substrate. Using H₂SO₄, the best results are attained at a concentration by weight of H₂SO₄ of at least 25%.

According to one convenient mode of carrying out the process of the invention, a reactor equipped with stirrer, thermometer, tap funnel and cooler is charged with acid medium the phenyl-urea or the carbanylate, the N-chloro-amine dissolved in an acid medium and the catalyst.

At the conclusion of the reaction, the reactor contents are poured onto crushed ice, whilst stirring, and any residual starting material is extracted from the acid solution by means of a suitable solvent, for example, chloroform, CCl_4 , ethyl acetate, ethyl ether, toluene, chlorobenzene, di-chlorobenzene, nitrobenzene or cyclohexane. The residue is then made alkaline with strong aqueous alkali, for example 30% caustic soda and the reaction product extracted.

For the extraction the most suitable solvent will depend on the particular product. Some generally suitable solvents are, for example, chloroform, carbon tetrachloride, ethyl ether, toluene and cyclohexane.

After distillation of the solvent, the desired products are generally already at a degree of purity appropriate to subsequent use. In some cases it may be useful to effect recrystallisation from a suitable solvent or fractional precipitation for example as the hydrochloride, sulphate or phosphate.

As the N - halo - amine it is possible to use, for instance: N - chloro - methylamine, N - chloro - dimethyl - amine, N - chloro - methyl - ethylamine, N - chloro - methyl - benzyl - amine, N - chloro - diethyl - amine, N - chloro - morpholine and N - chloro - piperidine.

Suitable phenyl - ureas include, for example: N - phenyl - urea, N - methyl - N - phenyl - urea, N - phenyl - N' - methyl - urea, N - phenyl - N':N' - dimethyl - urea, N - methyl - N - phenyl - N' - methyl - urea, N - methyl - N - phenyl - N':N' - dimethyl - urea, N - phenyl - N' - ethyl - urea, N - ethyl - N - phenyl - urea, N - phenyl - N':N' - diethyl - urea, N - ethyl - N - phenyl - N' - ethyl - urea, N - ethyl - N - phenyl - N':N' - diethyl - urea, N - phenyl - N' - phenyl - urea (carbanilide), N - methyl - N - phenyl - N' - phenyl - urea, N - methyl - N - phenyl - N' - methyl - N' - phenyl - urea, N - ethyl - N - phenyl - N' - phenyl - urea, N - ethyl - N - phenyl - N' - ethyl - N - phenyl - urea, N - methyl - N - phenyl - N':N' - diethyl - urea, N - methyl - N - phenyl - N' - methyl - N' - methyl - N - phenyl - N' - methyl - N' - ethyl - urea, N - ethyl - N - phenyl - N':N' - dimethyl - urea, N - phenyl - N' - ethyl - N' - phenyl - urea, N - methyl - N - phenyl - N' - ethyl - N' - phenyl - urea, N - 2 - nitro - phenyl - urea, N - 2 - chloro - phenyl - urea, N - 2 - bromo - phenyl - urea, N - 2 - iodo - phenyl - urea, N - 2 - methyl - phenyl - urea, N - 2 - isopropyl - phenyl - urea, N - 2 - chloro - phenyl - N - methyl - N' - ethyl - urea, N - 2 - methyl - phenyl - N':N' - dimethyl - urea, N - 2 - methyl - phenyl - N' - 2 - methyl - phenyl - urea, N - 2 - cyano - phenyl - urea, N - 2 - acetamino - phenyl - urea, N - 2 - methoxy - phenyl - urea, N - 2 - methoxy - phenyl - N':N' - dimethyl - urea, N - 2 - methoxy - phenyl - N' - ethyl - urea, N - 2 - methoxy - phenyl - N':N' - diethyl - urea, N - methyl - N - 2 - ethoxy - phenyl - urea, N - 2 - hydroxy - phenyl - urea, N - 3 - chloro - phenyl - urea, N - 3 - methyl - phenyl - urea, N - methyl - N - 3 - chloro - phenyl - urea, N - ethyl - N - 3 - chloro - phenyl - urea, N - methyl - N - 3 - chloro - phenyl - N' - dimethyl - urea, N - 3 - chloro - phenyl - N':N' - diethyl - urea, N - 3 - methyl - phenyl - N':N' - diethyl - urea, N - 3 - ethoxy - phenyl - urea or N - 3 - methoxy - phenyl - urea, N - 3 - hydroxy - phenyl - urea, N - 2 - tert - butyl - phenyl - urea, N - 3 - methoxy - phenyl - N':N' - diethyl - urea, N - methyl - N - 3 - methoxy - phenyl - urea, N - 4 - chloro - phenyl - urea, N - 4 - methyl - phenyl - urea, N - 4 - hydroxy - phenyl - urea, N - 4 - methoxy - phenyl - urea, N - 4 - ethoxy - phenyl - urea, N - 4 - acetamino - phenyl - urea, N - 4 - ureido - phenyl - urea, N - ethyl - N - 4 - chloro - phenyl - N':N' - diethyl - urea, N - methyl - N - 4 - methoxy - phenyl - urea, N - 4 - methoxy - phenyl - N':N' - dimethyl - urea, N - 4 - methoxy - phenyl - N' - ethyl - urea, N - 4 - methoxy - phenyl - N' - methyl - urea, N - methyl - N - 4 - methoxy - phenyl - N':N' - dimethyl - urea, N - methyl - N - 4 - methoxy - phenyl - N':N' - diethyl - urea, N - 4 - ethoxy - phenyl - N' - ethyl - urea, N - 4 - ethoxy - phenyl - N':N' - dimethyl - urea, N - 4 - ethoxy - phenyl - N':N' - diethyl - urea, N - 2,5 - dimethoxy - phenyl - urea, N - 2,5 - dimethyl - phenyl - urea, N - 4 - methoxy - phenyl - N' - 4' - methoxy - phenyl - urea, N - 4 - ethoxy - phenyl - N' - 4' - ethoxy - phenyl - urea, N - phenyl - N' - 3':5' - dinitro - phenyl - urea, N - 4 - methyl - phenyl - N' - 3':5' - dinitro - phenyl - urea, N - 4 - ethoxy - phenyl - N' - 3':5' - dinitro - phenyl - urea, N - 4 - methoxy - phenyl - N' - 3':5' - dinitro - phenyl - urea, N - phenyl - N' - 3':5' - dicyano - phenyl - urea, N - 4 - methyl - phenyl - N' - 3':5' - dicyano - phenyl - urea, N - 4 - methoxy - phenyl - N' - 3':5' - dicyano - phenyl - urea, N - 4 - ethoxy - phenyl - N' - 3':5' - dicyano - phenyl - urea, N - phenyl - N' - 3' - nitro - 5' - cyano - phenyl - urea, N - phenyl - N' - chloro - ethyl - urea, N - phenyl - N' - cyanoethyl - urea, N - phenyl - N' - sulphopropyl - urea, N - phenyl - N' - hydroxypropyl - urea, N - phenyl - N' - ethoxy - valeryl - urea, N - phenyl - N' - aminobutyl - urea, N - methyl - N - phenyl - N' - hydroxypropyl - urea,

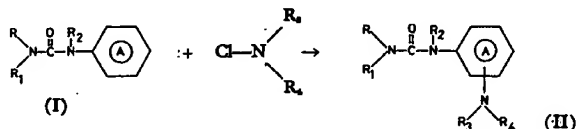
N - ethyl - N - 4 - ethoxy - phenyl - N' - sulphpropyl - urea, N - 4 - ethoxy - phenyl - N' - cyanoethyl - urea, N - 4 - (2 - hydroxy - ethoxy) - phenyl - N' - hydroxy - ethyl - urea, N - methyl - N - 4 - methyl - propionyl - phenyl - N' - chloroethyl - urea, N - 4 - (2 - hydroxy - ethoxy) - phenyl - urea, N - 4 - methyl - propionyl - phenyl - urea, N - 4 - cyanoethoxy - phenyl - urea, N - 4 - cyclohexoxy - phenyl - urea, N - 4 - methoxy - propionyl - oxy - phenyl - urea, N - 4 - (2 - ethoxy - ethoxy) - phenyl - urea, N - 4 - isopropoxy - phenyl - urea, N - 4 - t - butoxy - phenyl - urea, N - methyl - N - 4 - cyclohexoxy - phenyl - urea, N - methyl - N - 4 - (2 - hydroxy - ethoxy) - phenyl - urea, N - ethyl - N - 4 - methyl - propionyl - phenyl - urea, N - ethyl - N - phenyl - N' - cyclohexyl - urea, N - phenyl - N' - cyclohexyl - urea, N - 4 - methoxy - phenyl - N' - cyclohexyl - urea, N - methyl - N - 4 - ethoxy - phenyl - N' - cyclohexyl - urea, N - ethyl - N - 4 - methoxy - phenyl - N' - cyclohexyl - urea, N - 4 - cyclohexoxy - phenyl - N' - cyclohexyl - urea, N - ethyl - N - 4 - (2 - hydroxy - ethoxy) - phenyl - N' - cyclohexyl - urea and N - methyl - N - phenyl - N' - ethyl - urea.

Suitable carbonylates may be the derivatives of methyl or ethyl carbonylate, such as for example: N - methyl - methyl - carbonylate, 4 - methoxy - methyl carbonylate, N - methyl - 4 - methoxy - methyl carbonylate, N - ethyl - methyl carbonylate, N - ethyl - 4 - methoxy - methyl carbonylate, 2 - nitro - methyl carbonylate, 2 - chloro - methyl carbonylate, 2 - bromo - methyl carbonylate, 2 - iodo - methyl - carbonylate, 2 - methyl - methyl carbonylate, 2 - ethyl - methyl carbonylate, 2 - isopropyl - methyl carbonylate, 2 - tert. butyl - methyl carbonylate, N - methyl - 2 - chloro - methyl carbonylate, N - ethyl - 2 - methyl - methyl carbonylate, 2 - cyano - methyl carbonylate, 2 - methoxy - methyl carbonylate, 2 - hydroxy - methyl carbonylate, 2 - ethoxy - methyl carbonylate, N - ethyl - 2 - ethoxy - methyl carbonylate, N - methyl - 2 - acetyl amino - methyl carbonylate, 3 - chloro - methyl carbonylate, 3 - methyl - methyl carbonylate, 3 - methoxy - methyl carbonylate, 3 - hydroxy - methyl carbonylate, 3 - ethoxy - methyl carbonylate, N - methyl - 3 - methoxy - methyl carbonylate, N - methyl - 3 - methyl - methyl carbonylate, N - ethyl - 3 - ethoxy - methyl carbonylate, N - ethyl - 3 - methoxy - methyl carbonylate, 4 - chloro - methyl carbonylate, 4 - methoxy - methyl carbonylate, 4 - methyl - methyl carbonylate, 4 - ethoxy - methyl carbonylate, 2,5 - dimethoxy - methyl carbonylate, 2,5 - dimethyl - methyl carbonylate, 4 - (beta - hydroxy) - ethoxy - methyl carbonylate, 4 - methoxypropionyl - oxymethyl carbonylate, 4 - (beta - cyano) - ethoxy - methyl carbonylate, 4 - cyclohexyloxy - methyl carbonylate, 4 - (beta - ethoxy) - ethoxy - methyl carbonylate, 4 - isopropoxy - methyl carbonylate, 4 - t - butoxy - methyl carbonylate, N - cyclohexyl - methyl carbonylate, N - ethyl - 4 - ethoxy - methyl carbonylate, N - cyclohexyl - 4 - methoxy - methyl carbonylate, N - ethyl - 4 - cyclohexyl - oxy - methyl carbonylate, N - methyl - 4 - (beta - cyano) - ethoxy - methyl carbonylate, N - ethyl - 4 - (beta - hydroxy) - ethoxy - methyl carbonylate, N - methyl - 4 - methoxy - propionyl - oxy - methyl carbonylate and N - ethyl - 4 - (beta - ethoxy) - ethoxy - methyl carbonylate.

For the compounds listed hereinbefore it is understood that the methyl of the ester group can be substituted by an ethyl.

Other employable carbonylates are for example: beta - chloro - ethyl carbonylate, beta - cyano - ethyl carbonylate, propyl carbonylate, isopropyl carbonylate, tert. - butyl carbonylate, cyclohexyl carbonylate, beta - hydroxy - ethyl carbonylate, beta - chloro - ethyl N - methyl - carbonylate, cyclohexyl N - ethyl - carbonylate, cyclohexyl N - cyclohexyl - carbonylate, beta - cyano - ethyl N - methyl - carbonylate, propyl 4 - methoxy - carbonylate, tert. - butyl 4 - methoxy - carbonylate, isopropyl N - methyl - 4 - methoxy - carbonylate, N - cyclohexyl - 4 - cyclohexoxy - cyclohexyl carbonylate and N - ethyl - 4 - ethoxy beta - cyano - ethyl carbonylate.

The process of aminating phenyl-ureas according to the invention can be represented as follows:



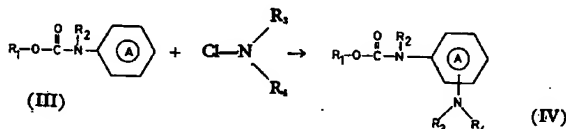
wherein R and R₁, which may be the same or different, may be hydrogen or alkyl, cycloalkyl, aryl, aralkyl, these in turn being optionally substituted; R₂ may be hydrogen or alkyl, cycloalkyl, aryl, or aralkyl, optionally substituted; R₃ and R₄, which may be the same or different, may be optionally substituted alkyl, cycloalkyl or aralkyl, and

one of the two, R_1 or R_2 , may be hydrogen. R_3 and R_4 may also be the residue of a ring, optionally substituted, which may or may not contain one or more additional hetero-atoms; and A is a benzene ring with at least one free position.

The substituents of R_1 , R_2 , R_3 , R_4 and A, when present, may be, for example halo, nitrile, sulphonyl, carboxyl and esters thereof, amino-hydroxyl, alkyl, substituted alkyl, alkoxy, substituted alkoxy, acylamino, cycloalkyloxy or uric groups; the preferred substituents of the alkyl and alkoxy groups, where present, are halo, hydroxyl, carboxyl and sulphonyl groups and esters thereof, nitrilo and alkoxy.

When R_1 , R_2 , R_3 , and R_4 signify alkyl or alkoxy, their alkyl chains contain preferably 1 to 5 carbon atoms.

The process according to the invention for aminating carbonylates with N-chloroamines can be represented as follows:



wherein R_1 and R_2 , which may be the same or different may for example be alkyl or cycloalkyl, aryl or aralkyl, which in their turn may be substituted; further, R_3 but not R_4 may be H; R_3 and R_4 , which may also be the same or different, except that only one of them may be H, may be, for example, alkyl, cycloalkyl or aralkyl, which in their turn may be substituted. Furthermore, R_3 and R_4 may together constitute the residue of a ring, with or without one or more additional hetero atoms; A is a benzene nucleus, having at least one free position.

The substituents of R_1 , R_2 , R_3 , R_4 and A, may be, for example, halo, nitrilo, sulphonyl or carboxyl and esters thereof, amino, hydroxyl, alkyl, substituted alkyl, alkoxy, substituted alkoxy, acylamino, cycloalkyloxy, or uric groups; furthermore the substituents of the alkyl and alkoxy, when present, may be, for instance, halo, hydroxyl, carboxyl or sulphonyl or esters thereof, nitrilo or alkoxy.

When R_1 , R_2 , R_3 , R_4 here signify an alkyl or an alkoxy group, the alkyl chain preferably contains from 1 to 5 carbon atoms.

The method of synthesising aromatic N-alkyl-amines by amination of aromatic substrates with N-chloro-amines, in the presence of a reducing salt in an acid reaction medium, has already been described in US patent No. 3 483 255, according to which aromatic compounds, either unsubstituted or monosubstituted with chlorine, bromine, iodine or OCH_3 , are alkylaminated. The reducing salt forms a redox system with the N-chloro-amine.

It was to be expected that, by adopting this procedure, N-chloro-ureas and chlorination products of the side chains should form in the case of substituted ureas.

In the case of carbonylates also it was to be expected that, by adopting this procedure, by-products should form, such as N-chloro-carbonylates and chlorination products of the side chains in the substituted carbonylates, and furthermore that the carbonylates would suffer hydrolysis under the reaction conditions.

It has surprisingly been found by the Applicants that the above-indicated expectations do not or largely do not materialise and that the process of this invention is characterised by high yields and high selectivity whether using phenyl-ureas or carbonylates, or using phenyl-substituted phenyl-ureas and carbonylates.

For instance, when starting products such as N-phenyl-urea, N-phenyl-N'-ethyl-urea, N-methyl-N-phenyl-N':N'-dimethyl-urea and N-methyl-N-phenyl-N'-ethyl-urea are used, a selective linking in the para position in respect of nitrogen on A is obtained. If the phenyl is substituted in para position, i.e. if aromatic substrates are used such as N-4-methoxy-phenyl-urea, N-4-methoxy-phenyl-N'-ethyl-urea, N-4-ethoxy-phenyl-N'-ethyl-urea, N-4-hydroxy-phenyl-urea, N-4-cyclohexoxy-phenyl-N':N'-dimethyl-urea, N-methyl-N-4-chloro-phenyl-urea or N-4-ethoxy-phenyl-N':N'-dimethyl-urea, a selective linking in meta position in respect of nitrogen on A is obtained.

Conversely, if the phenyl is substituted in the ortho position, i.e. if substrates are used such as N-2-methyl-phenyl-urea, N-2-methyl-phenyl-N':N'-dimethyl-urea, N-2-chloro-phenyl-N'-ethyl-urea or N-methyl-N-2-bromo-phenyl-urea, a selective linking in the para position in respect of nitrogen on A is obtained.

As to the carbonylates, when starting products are used such as methyl or ethyl carbonylates, N - methyl - ethyl carbonylate or N - ethyl - methyl carbonylate, selective linking in the para position in respect of the nitrogen on A is obtained.

If the phenyl is substituted in the para position, i.e. if starting products are utilized such as 4 - methoxy - methyl carbonylate, 4 - ethoxy - methyl carbonylate, 4 - methoxy - ethyl carbonylate, 4 - ethoxy - ethyl carbonylate or N - methyl - 4 - methoxy-methyl carbonylate, selective attachment in the meta position in respect of the nitrogen on A is obtained.

Conversely, if the phenyl is substituted in the ortho position, as with 2 - methyl-methyl carbonylate, 2 - chloro - ethyl carbonylate or 2 - methyl - ethyl carbonylate, selective attachment in the para position in respect of the nitrogen on A is obtained.

The following Examples illustrate how the invention may be carried into effect, without limiting more general aspects thereof. In the Examples, unless otherwise specified, the term "parts" is to be understood as being by weight. For the Examples relating to phenyl-ureas, the yield is calculated on the amount of N-chloro-amine used; while for the Examples concerning the carbonylates, the yield is calculated on the amount of carbonylate converted.

A. Preparation of amino-phenyl-ureas

EXAMPLE 1.

Into a reactor equipped with stirrer, condenser, thermometer and dropping funnel, 60 parts of concentrated H_2SO_4 were charged followed, whilst keeping the temperature below $10^\circ C$, by 8.2 parts of N - phenyl - N' - ethyl - urea. Then, whilst stirring, there were added 41.7 parts of a 9.65% sulphuric acid solution of N - chloro - dimethyl - amine, corresponding to 4 parts of the amine. This was followed by 7 parts of $FeSO_4 \cdot 7H_2O$, charged batchwise.

The reaction was allowed to proceed for 2 hours, whereupon the reactor contents were poured onto 150 parts of crushed ice. After extraction with chloroform, the solvent was distilled off and 2.4 parts of starting product were recovered. The aqueous residue was made alkaline with 30% NaOH and, after extraction with chloroform, the solvent was distilled off, giving 7.7 parts of N - para - dimethylamino - phenyl - N' - ethyl - urea with a titre of 93.4%. The yield was thus about 69.5%. The melting point of the product was $154-156.5^\circ C$.

EXAMPLE 2.

Following the procedure of Example 1, there were charged: 23.8 parts of a 25.2% sulphuric acid solution of N-chloro-piperidine corresponding to about 6 parts of amine, 60 parts of concentrated H_2SO_4 and, keeping the temperature below $0^\circ C$, 8.2 parts of N - phenyl - N' - ethyl - urea. The 7 parts of $FeSO_4 \cdot 7H_2O$ were then charged batchwise. After the 2 hours of reaction the reactor contents were poured onto 150 parts of crushed ice, extracted with chloroform to recover 2.9 parts of starting product, and again extracted to yield 8.9 parts of N - para - piperidino - phenyl - N' - ethyl - urea with a titre of 90.2%. The yield was 65%; the melting point of the product $162.5-164.5^\circ C$.

EXAMPLE 3.

Again proceeding as in Example 1, 150 parts of concentrated H_2SO_4 were charged followed, at below $20^\circ C$, by 19.4 parts of N - 4 - methoxy - phenyl - N' - ethyl - urea. Then, whilst stirring, 37.5 parts of a 21.2% sulphuric acid solution of N - chloro - dimethyl - amine were added, corresponding to about 8 parts of the amine.

14 parts of $FeSO_4 \cdot 7H_2O$ were added incrementally, and the mixture left to react for 2 hours, whereupon the reactor contents were poured onto 300 parts of crushed ice. By extraction with chloroform, 1.7 parts of starting product were obtained. After making alkaline with 30% NaOH, extraction with chloroform and distillation of the solvent, there were obtained 22.3 parts of N - 3 - dimethylamino - 4 - methoxy - phenyl - N' - ethyl - urea with a titre of 94%. The yield was about 90%; the melting point of the product was $114.5-115.5^\circ C$.

EXAMPLE 4.

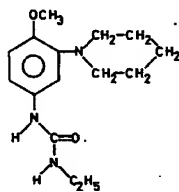
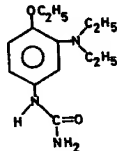
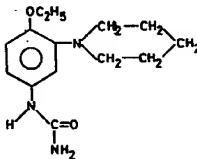
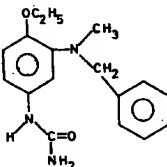
Following generally the procedure of Example 1, 60 parts of concentrated H_2SO_4 , were charged and, keeping the temperature below $10^\circ C$, 9 parts of N - 4 - ethoxy-phenyl - urea were added. Whilst stirring, there were then charged 40 parts of a 9.94% sulphuric acid solution of N - chloro - dimethyl - amine, corresponding to about 4

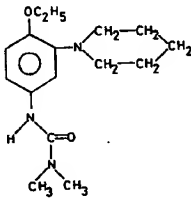
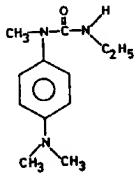
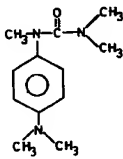
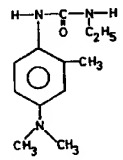
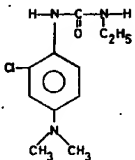
parts of the amine. 6 parts of FeCl_2 were then added incrementally. 9 parts of 94.7% N - 3 - dimethyl - amino - 4 - ethoxy - phenyl - urea were obtained, representing a yield of 76.4%; the melting point was $134^\circ\text{--}137^\circ\text{C}$.

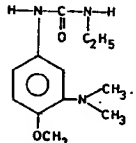
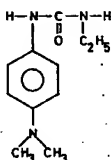
EXAMPLE 5.

5 Into a reactor similar to that of Example 1, 50 parts of concentrated H_2SO_4 were charged and, keeping the temperature below -5°C , 10.4 parts of N - 4 - ethoxy-phenyl - N':N' - dimethyl - urea were added. 4 parts of N - chloro - dimethyl - amine, dissolved in 35 parts of concentrated H_2SO_4 , were then added whilst stirring, followed by the incremental addition of 3.5 parts of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. Following the procedure of Example 1, there were obtained 9.6 parts of 94.4% N - 3 - dimethyl - amino - 4 - ethoxy - phenyl - N':N' - dimethyl - urea. This represents a yield of 72%, the melting point was $129\text{--}131.5^\circ\text{C}$.

By operating as set out in Example 3, the following products were prepared:

Ex. No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
6	96% H_2SO_4	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$		Eluent No. 1 R.F. = 0.5 Unitary
7	96% H_2SO_4	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$		Eluent No. 1 R.F. = 0.1 Unitary
8	96% H_2SO_4	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$		Eluent No. 1 R.F. = 0.1 Unitary
9	96% H_2SO_4	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$		Eluent No. 2 R.F. = 0.2 Unitary

Example No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
10	96% H ₂ SO ₄	FeSO ₄ ·7H ₂ O	 <chem>CCN(C)C(=O)N(c1ccc(OCC)cc1)CC(C)C</chem>	Eluent No. 1 R.F. = 0.1 Unitary
11	96% H ₂ SO ₄	FeSO ₄ ·7H ₂ O	 <chem>CCN(C)C(=O)N(C)Cc1ccc(N(C)C)cc1</chem>	Eluent No. 1 R.F. = 0.65 Unitary
12	conc. H ₂ SO ₄	FeSO ₄ ·7H ₂ O	 <chem>CN(C)C(=O)N(C)Cc1ccc(N(C)C)cc1</chem>	Eluent No. 1 R.F. = 0.65 Unitary
13	conc. H ₂ SO ₄	FeSO ₄ ·7H ₂ O	 <chem>CCN(C)C(=O)N(C)Cc1cc(C)cc(N(C)C)c1</chem>	Eluent No. 1 R.F. = 0.2 Unitary
14	conc. H ₂ SO ₄	FeSO ₄ ·7H ₂ O	 <chem>CCN(C)C(=O)N(C)Cc1cc(Cl)cc(N(C)C)c1</chem>	Eluent No. 1 R.F. = 0.2 Unitary

Ex. No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
15	conc. H_2SO_4 : 80 Acetic acid : 20	$FeSO_4 \cdot 7H_2O$		Eluent No. 2 R.F. = 0.1 Unitary
16	conc. H_2SO_4	$TiCl_3$		Eluent No. 1 R.F. = 0.2 Unitary

All the products were eluted on silicic acid. Eluent No. 1: benzene 79 parts, methanol 14 parts, acetic acid 7 parts. Eluent No. 2: toluene 50 parts, ethyl acetate 50 parts.

- 5 The product of Example 15 exhibited the same melting point and the same spectrum as that obtained in Example No. 3. The product of Example No. 16 exhibited the same melting point and the same spectrum as that obtained in Example No. 1.

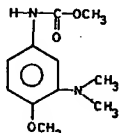
B. Preparation of amino-carbonylates

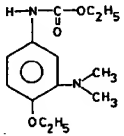
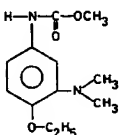
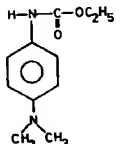
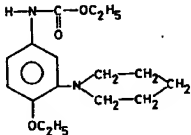
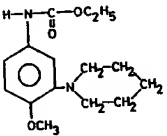
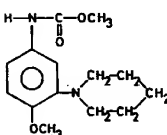
EXAMPLE 1.

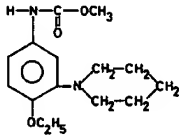
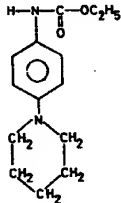
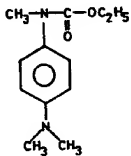
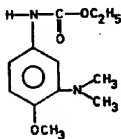
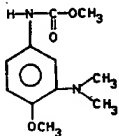
- 10 Into a reactor equipped with stirrer, cooler, thermometer and dropping funnel there were charged 60 parts of concentrated H_2SO_4 and, keeping the temperature below $0^\circ C$, there were then charged 9.75 parts of 4-methoxy-ethyl carbonylate. Whilst stirring, there were added 19.1 parts of a 20.8% sulphuric acid solution of N-chloro-N,N-dimethyl-amine corresponding to about 4 parts of the amine. 7 parts of $FeSO_4 \cdot 7H_2O$ were then charged incrementally.

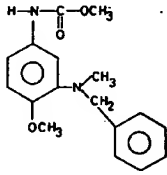
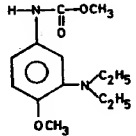
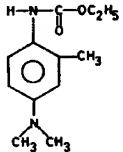
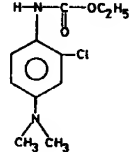
- 15 The reaction was allowed to proceed for 2 hours, whereupon the reactor contents were poured onto 150 parts of crushed ice. After extraction with chloroform and distillation of the solvent 3.68 parts of unreacted product were recovered. The aqueous residue was then made alkaline with 30% NaOH and, after extraction with chloroform and distillation of the solvent there were obtained 7.26 parts of 3-N,N-dimethyl-N-(4-methoxyethyl)-amino-4-methoxyethyl carbonylic acid with a titre of 90.7%. This represents a yield of about 95%. The product eluted on salicylic acid exhibited a R.F. of 0.5 using an eluent consisting of 50 parts of toluene and 50 parts of ethyl acetate; and also a R.F. of 0.5 with an eluent consisting of 79 parts of benzene, 14 parts of methanol and 7 parts of acetic acid.

By operating according to Example B1, but varying the starting materials, i.e. the type of carbonylate and chloro-amine, the following products were prepared:

Example No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
2	H_2SO_4 96%	$FeSO_4$		Eluent No. 2 R.F. = 0.4 Unitary

Example No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
3	H ₂ SO ₄ 98%	FeSO ₄		Eluent No. 2 R.F.: 0.6 Unitary
4	H ₂ SO ₄ 90%	FeSO ₄		Eluent No. 2 R.F.: 0.6 Unitary
5	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 1 R.F.: 0.35 Unitary
6	H ₂ SO ₄ 90%	FeSO ₄		Eluent No. 2 R.F.: 0.7 Unitary
7	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 2 R.F.: 0.65 Unitary
8	H ₂ SO ₄ 98%	FeSO ₄		Eluent No. 2 R.F.: 0.65 Unitary

Example No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
9	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 2 R.F.: 0.75 Unitary
10	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 1 R.F.: 0.6 Unitary
11	H ₂ SO ₄ 90%	FeSO ₄		Eluent No. 2 R.F.: 0.7 Unitary
12	$\frac{\text{H}_2\text{SO}_4 \text{ 96\%}}{\text{CH}_3\text{COOH} \text{ 15\%}}$	FeSO ₄		Eluent No. 2 R.F.: 0.5 Unitary
13	H ₂ SO ₄ 98%	TiCl ₄		Eluent No. 2 R.F.: 0.4 Unitary

Example No.	Acid mixture	Catalyst	Formula	Chromatographic analysis
14	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 2 R.F.: 0.5 Unitary
15	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 2 R.F.: 0.45 Unitary
16	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 1 R.F.: 0.4 Unitary
17	H ₂ SO ₄ 96%	FeSO ₄		Eluent No. 1 R.F.: 0.45 Unitary

All the products were eluted on silicic acid.

Eluent No. 1: benzene 79 — methanol 14 — acetic acid 7 parts.

Eluent No. 2: toluene 50 — ethyl acetate 50 parts.

WHAT WE CLAIM IS:—

1. A process for preparing an amino phenyl urea or aminocarbonylate by direct amination of a phenyl urea or a carbonyl acid ester with an N-chloro-amine, in a redox type system and in an acid reaction medium.
2. A process according to claim 1, in which the N-chloro-amine has the formula ClNR_3R_4 , wherein R_3 is a substituted or unsubstituted alkyl, cycloalkyl or aralkyl group, R_4 is hydrogen or substituted or unsubstituted alkyl, cycloalkyl or aralkyl, or R_3 and R_4 are residues of a ring which may be substituted and may or may not contain one or more other heteroatoms.
3. A process according to claim 1 or 2, using a phenyl-urea of the general formula (1) as hereinbefore defined.

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4. A process according to claim 1, wherein the reagents used are chosen to give an aminophenyl urea of the general formula II hereinbefore defined.
5. A process according to claim 1 or 2, in which a carbonyl acid ester is used of the general formula III as hereinbefore defined.
- 5 6. A process according to claim 1 or 2, wherein the reagents used are chosen to give an amino-substituted carbonyl acid of the general formula IV hereinbefore defined.
7. A process according to any foregoing claim, in which the reaction medium contains a strong acid selected from sulphuric acid, trifluoroacetic acid and mixtures thereof with acetic acid, and a ferrous, cuprous or titanous salt.
- 10 8. A process according to claim 7, in which the acid reaction medium contains ferrous sulphate.
9. A process according to claim 7 or 8, in which the acid reaction medium comprises H_2SO_4 of a weight concentration of at least 25%.
- 15 10. A process according to any foregoing claim, in which the N-chloro-amine is employed at a molar ratio of 1:3 to 3:1 in respect of phenyl-urea or carbonylic acid ester.
11. A process according to any of the foregoing claims, in which ferrous sulphate is employed to form a redox system with the N-chloro amine at a molar ratio of from 1:1 to 1:100 to the N-chloro-amine.
- 20 12. A process according to claim 11 wherein said ratio is from 1:1.2 to 1:50.
13. A process according to claim 1 in which the reactants are selected from those hereinbefore specifically referred to.
- 25 14. A process according to claim 13, substantially as set forth in any of the foregoing Examples.
15. Amino phenyl ureas and aminocarbonylates when produced according to any of the foregoing claims.

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